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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/539,254

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EXAMINER

KACKAR, RAM N

ART UNIT

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1792

MAIL DATE

DELIVERY MODE

11/12/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/539,254	Applicant(s) MIYAKE ET AL.	
	Examiner Ram N. Kackar	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 December 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 5-8, 10-15, 17, 20-25, 27-29 and 31-56 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 11, 12, 40, 43, 46, 49, 52 and 55 is/are allowed.
- 6) ☒ Claim(s) 5-8, 10, 13-15, 17, 20-25, 27-29, 31 -39, 41, 42, 44, 45, 47, 48, 50, 51, 53, 54 and 56 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Drawings

1. The subject matter of this application admits of illustration by a drawing to facilitate understanding of the invention. Applicant is required to furnish a drawing under 37 CFR 1.81(c). No new matter may be introduced in the required drawing. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d).

Claim 20 recites a capacitor located in proximity to an antenna is disclosed to detect voltage applied to the antenna. This capacitor 45 is not shown on drawing 22 or 23. Correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 8, 10, 32-33, 39, 42, 45, 48, 51 and 54 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Use of the term "aspect ratio" in claim 8 is indefinite. Firstly the aspect ratio is coined by the applicant for a U shaped antenna and is not a commonly understood term. Secondly aspect ratio is not a unique parameter to affect the plasma density. For example if both sides of the antenna are increased or decreased proportionately, the aspect ratio will not change but the plasma density and its distribution may change since antennas position with respect to the chamber will change.

Still further the term "target area" in claim 8 is a relative term which renders the claim indefinite. The term "target area" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claim 20 is indefinite since the specification does not disclose how applied RF voltage is detected by a capacitor.

The term "equal polarity" in claim 32 is not understood. For the examination it is interpreted as same polarity.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 5-8, 10, 23-25, 27-29, 31, 36-39, 42, 45, 48, 51 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masaji et al (JP 2001-035697) in view of Yamakoshi et al (US 2001/0021422).

Masaji et al disclose a plasma generator for a vacuum chamber (Abstract), a stage (Fig 1-4) to hold a substrate (base plate) and multiple RF antennas attached to sidewalls arranged parallel to the stage (Fig 11). The antennas are connected in parallel. Although the length of conductor is not disclosed it can be fairly estimated from the size of the vacuum housing and the

frequency applied (13.54 MHz- $\lambda/4 = 5.5\text{m}$) that it is much less than $\lambda/4$. The antennas are connected in parallel and could be coated with an insulator. Also disclosed are impedance elements (11) and (C_b).

Masaji et al however do not disclose that antennas are connected through a conductive plate.

Yamakoshi et al disclose a plasma generator for a vacuum chamber (Abstract), a stage (Fig 29) to hold a substrate (base plate) and multiple RF antennas attached to sidewalls arranged parallel to the stage through a plate shaped conductor 26a, 26b outside the vacuum chamber (See for example Fig 29, 30 and paragraph 141). Although the length of conductor is not disclosed it can be fairly estimated from the size of the vacuum housing and the frequency applied (13.54 MHz- $\lambda/4 = 5.5\text{m}$) that it is much less than $\lambda/4$. The antennas are connected in parallel. Yamakoshi et al further teach phase detectors and phase shifters (phase matcher) and power meters for regulating the phases of RF power supplied to the antennas (electrode) and impedance matching circuits controlled by controller.

Yamakoshi et al disclose a plasma generator for a vacuum chamber (Abstract), a stage (Fig 29) to hold a substrate (base plate) and multiple RF antennas attached to sidewalls arranged parallel to the stage through a plate shaped conductor 26a, 26b outside the vacuum chamber (See for example Fig 29, 30 and paragraph 141).

Since plate like conductors can provide secure connections at required distance (important since that may introduce some phase shift) it would be obvious for one of ordinary skill in the art at the time of invention to use plate like conductors for parallel connections.

Regarding the limitation of aspect ratio of the antenna according to the definition of the aspect ratio in the specification it is clear that aspect ratio determines the projection of the antenna towards the center of the substrate, it is obvious that the RF field (inductive as well as capacitive) will be oriented further in according to this projection. The very fact that Masaji et al disclose multiple antennas is the recognition that antennas have stronger RF fields in their vicinity and by controlling there position spatial distribution of plasma density is controlled.

It is noted that no specific relation ship between aspect ratio and plasma property at a specified target is claimed.

Regarding RF antennas disposed on all walls Masaji et al disclose disposal of antennas to cover the plasma space uniformly. Regarding drawing 11 one wall is shown including an exhaust and for simplicity antennas are not shown. Further Yamakoshi et al also disclose uniform disposal of antennas. There would be no purpose in placing antennas asymmetrically.

6. Claims 13-15, 17, 20-21, 34, 41, 44, 47, 50, 53, 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masaji et al (JP 2001-035697) in view of Okumura et al (JP 2000-058296) and further in view of Nakamura et al (JP 2001094485).

Masaji et al as discussed above do not explicitly disclose measurement and feedback control of antenna power.

Okumura et al disclose a plasma control method using a plasma generator having multiple RF antennas located within a vacuum chamber (21-24), and being arranged on a ceiling wall of the vacuum chamber and parallel to a stage on which a base plate is to be placed;

a measurement unit for measuring a current of each RF antenna (41-44) including a pick-up coil;

an impedance element that has a variable impedance value (45-48) for regulating a (power which regulates both a current and/or a voltage of each RF antenna) is connected to each of the RF antennas;

a controller (40) used for setting the variable impedance (See Fig 5a-5g for control of variable impedance) value on the basis of the voltage or current measured with the measurement unit, and a plasma density distribution within the vacuum chamber controlled by regulating the impedance value of each impedance element.

A capacitor as a part of measurement would be inherent to rectify alternating voltage picked up by coil for signal going to the controller.

Nakamura et al disclose a pick up coil for detection of power (current and voltage) in an antenna which is rectified and converted to digital signal using a capacitor for the purpose of controlling out put of the antenna (See the abstract and Figs 1- 3).

Therefore having power detection and feed back control for Masaji according to the teaching of Okumura et al in view of Nakamura et al would have been obvious for one of ordinary skill in the art at the time of invention.

7. Claims 22 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masaji et al (JP 2001-035697) in view of Okumura et al (JP 2000-058296) in view of Nakamura et al (JP 2001094485) in view of Koji Oku (JP 08162291).

Masaji in view of Okumura et al and Nakamura et al do not disclose a mixer for voltage and current signals to measure power.

Koji Oku disclose a high-frequency power source (Fig 1-10) comprising a matching box (30) and a power detection circuit (40), wherein the power detection circuit comprises a low pass filter (47) for conducting frequency mixing in double balanced mixers (46a, b) and removing the high-frequency components from the output of the double balanced mixers using local oscillator (45) and further low pass filter (49). Therefore power detection circuit converts the frequency of the high-frequency power to a low frequency and conducts detection based on the low-frequency power. Further the detected signal is used as negative feedback for control of high frequency power (Abstract and Fig 2).

Therefore it would have been obvious for one of ordinary skill in the art to measure power in the way taught by Koji Oku in order to be able to control it precisely in the apparatus of Masaji as modified by Okumura et al and Nakamura et al.

8. Claims 27-28 are also rejected under 35 U.S.C. 103(a) as being unpatentable over Masaji et al (JP 2001-035697) in view of Yamakoshi et al (US 2001/0021422) and further in view of Kojin Nakagawa (JP 08325759).

Yamakoshi et al in view of Yamakoshi et al do not explicitly disclose controlling plasma by regulating antenna length.

Kojin Nakagawa discusses the relationship of length vs. wavelength/frequency and uniformity (Paragraph 7-10 and 34-35).

Therefore regulating the length to get maximum uniformity would be obvious to one of ordinary skill in the art at the time of invention.

Allowable Subject Matter

Claims 11-12, 40, 43, 46, 49, 52 and 55 are allowed. These claims recite U shaped antennas where adjacent electrodes of adjacent antenna are connected to same polarity (power or ground). Claims 32-33 would be allowable if Sec 112 rejection is removed by proper amendment.

Response to Arguments

Applicant's arguments filed 8/3/2009 have been fully considered but they are not persuasive.

Responses to applicant's arguments are discussed in the rejection above. Arguments regarding claim 11 and 32 are persuasive to indicate allowable subject matter.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

Art Unit: 1792

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ram N. Kackar whose telephone number is 571 272 1436. The examiner can normally be reached on M-F 8:00 A.M to 5:P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571 272 1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ram N Kackar/
Primary Examiner, Art Unit 1792